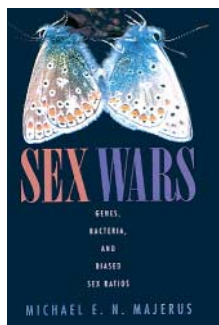


Why sex?

Jürgen Tautz

Sex Wars: Genes, Bacteria and Biased Sex Ratios
by Michael E. N. Majerus
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Sex seems to be synonymous with fertility, reproduction and the continuation of life, so it may be astonishing to hear that there is still no easy explanation why sex has evolved and why it is such a stable phenomenon. The deep

root of sex is not reproduction (which may not be accepted with enthusiasm by religious fundamentalists), but the creation of many genetically and thus phenotypically diverse organisms. Bacteria and protozoans come into contact, exchange parts of their genomes and split apart again. In essence, after this sexual process, they are once again two individuals, but now they are different. However, there are many examples of plants and animals that successfully reproduce without sex. Parthenogenesis, the process by which females produce offspring without a male, is more efficient than sexual reproduction. So why bother with sex? And why are there as many males as females in a sexually reproducing population when a handful of males would be sufficient to guarantee survival?

In *Sex Wars: Genes, Bacteria and Biased Sex Ratios*, evolutionary geneticist Michael E. N. Majerus delves deep into the secrets of sex. He describes common

sex determination mechanisms such as sex chromosomes, their number relative to autosomes, and single gene sex loci. At the beginning of the book, he explains how the "logic of sex" leads to competitive males and choosy females. Questions like "Why are there roughly as many males as females in most species?" and "Why is this ratio permanently disturbed in special cases?" are interesting problems that he brings to the attention of the reader, and solves on the basis of established arguments from an evolutionary perspective. But even simpler and more surprising for those who may never have thought about them are the questions "What are males and females, anyway?", "Is a clear distinction between these two forms of individuality always possible?" and "What determines the sex of an individual?"

Majerus answers these questions in the first three chapters of the book before turning to more complex matters, largely the amazing role of bacteria in determining the sex life of certain animal species. He portrays bacteria not so much as health hazards, although this influence on animals is accepted as one explanation for the evolution of sex: the immune system of sexually produced offspring is optimally diverse, and such animals are well prepared to fight parasites and pathogens. Rather, Majerus describes a different role for bacteria in the sex life of animals: symbiotic bacteria have an interest in inhibiting the sex life of certain animal species, or in shifting the sex ratio towards one sex, typically female. Hard to believe, but an evolutionary arms race takes place with the microbial symbiont manipulating the sex determination system of its host for its own interests. What are these interests? The host clearly aims to produce as many males as females, as this represents an evolutionarily stable ratio. However, the microbial symbiont is not interested in individuals that produce sperm, as it cannot

be transmitted through sperm into a zygote and therefore vertically into the next generation of hosts. It can only sneak into the following generation through the large female egg. Indeed, the sex of an individual that is predetermined by their sex chromosomes can be changed (typically from male to female) under the influence of microbes.

Parthenogenesis is a form of secondary asexual reproduction that is known for almost all animal groups except mammals (setting aside the birth of Christ). In insects, the phenomenon is common. Particularly in hymenopterans, parthenogenesis is caused by an intracellular symbiotic bacterium, *Wolbachia*. Majerus not only clearly explains the evolutionary aspects of this fact (why is it in the interests of *Wolbachia* to have this effect on insects?), but also beautifully reconstructs the history of its discovery. Astonishingly, *Wolbachia* is also responsible for the extreme sex-ratio distortion in insects, even in those that undergo sexual reproduction. Once again, Majerus expresses clearly his evolution-focused thoughts on this situation. Finally, the possible use of *Wolbachia* in pest control is discussed. This may be taken as a tongue-in-cheek message that "no sex for some may be good for others".

The book is very easy to read. If one gets stuck on technical terms, a quick look at the detailed glossary at the end of the book will help. So many exciting discoveries, especially about the role of *Wolbachia* in the sex life of insects, have been made that the time was ripe for a book on this topic. *Sex Wars* fits the bill and could hardly be written better.

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